

#9/Response
w/ Sub-spec.
(FE)
V. Brown
9/25/03

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Sept. 7, 2003

Attention: Stanley J. Pruchnic, Jr.
Art Unit 2859
Mail Stop Patent Application
US Patent and Trademark Office
Washington, DC 20231

Dear Mr. Pruchnic,


We appreciate your careful review and precise comments. The revised manuscript and revised drawings are attached herewith for your further review.

Our response to your Detail Action –Drawings (page 2 of the Official Action Summary) is explained in the page stapled to this letter and also in our red inked text of pages 13, 14, and 26.

We have given careful attention to each of your further comments in the Official Action Summary and believe that we have been responsive to all of them. The detail application text has also been checked for minor errors and the corrected version is presented for your further review in the 33 black-ink pages including drawings.

Separately we have paid for our application extension time of 4 months under 37 CFR 1.136 (a) to Sept.20. using Form PTO/SB/22.

Respectfully submitted,


William N. Carr,
Inventor



Micro machined Pyro optical Structure

2859

Office Action Summary

Application No.

10/044,436

Applicant(s)

CARR ET AL.

Examiner

Stanley J. Pruchnic, Jr.

Art Unit

2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION. June 20, 03 mail date

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 April 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17²⁰ is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17²⁰ is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 April 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.6 (2 sheets)
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Explanation of corrections to DETAILED ACTION –Drawings page 2 from the examiner:

Item #2a: The lens is identified as 5 in Fig. 1

Item #2b: Fig. 1 is designated as Prior Art

Item 3c: The electrodes are 61 and 62 in Fig. 6. The lower electrode 61 is also seen in Fig. 5 as 25.

Item 3d: The gap 26 is shown in Fig. 2 as the space between 31 and 24, 25.

This gap is also the vertical spacing between the horizontal films 61 and 62 in Fig. 6.

Item 3e: Heater element identified as 10 in Fig. 2

Item 3f: The thermister is implemented as 51 in Fig. 5 . Reference to pn junction is deleted from Claim 12

Item 3g: Photodetector is merged into the substrate in Fig. 4 when 24 and 33 are merged

Item 3h: The vacuum chamber is indicated by 9 in Fig. 2

Item 3i: Claim 20 cancelled

Other: The reference to pn junctions is deleted from Claim 12.

Description of Preferred Embodiments

In the Fig. 2 first embodiment, a collimated or approximately collimated optical beam from an external LED beam 21 illuminates pyro-optical film 27 to form the first Fabry Perot structure. The two surfaces of dielectric film 27 comprise a Fabry Perot sandwich. A second Fabry Perot structure is comprised with the horizontal platform of structure 30 on the topside and metal reflector 25 on the lower side with a gap 26 separating the topside and lowerside planar surfaces. Two identical pixel structures 31 constitute the array of Fig. 2. An infrared beam 22 from an external low level source is focused onto the plane of the platform for processing by a second Fabry-Perot structure 23. Figure. 2 is a schematic cross-section view of a pyro-optical pixel with first and second Fabry-Perot structures optimized for sensor performance at specific wavelength bands for the optical carrier beam modulation and absorption of the low-level radiation, respectively. The pixel structures are typically mounted in a vacuum cavity 9. The temperature ambient within the enclosure cavity 9 can be controlled by means of a resistive heater element 10 which also can be time-multiplexed for use as a thermister to measure oven temperature. This cross-section shows two representative pixels

positioned over a photodetector array 33. The photodetector is integrated with the image converter structure 24 when components 24 and 33 are fabricated using a single starting silicon wafer including 33. An optically transparent material 24 is either in the form of a starting wafer such as quartz or a film such as silicon nitride and silicon dioxide or in the case where 24 is a film the structural substrate becomes 33 and the film 24 is integral with 33 without any gap therebetween.. Silicon nitride and silicon dioxide films can be deposited directly on the underlying photodetector and are often used to passivate the photodetector surface in processing technology well known to silicon photosensor art. Next, a first metal fully reflecting film 25 of aluminum or gold is sputtered and lithographically patterned on the substrate to form the cross-section shown in Fig. 2. The first metal film contains a via path for the externally-sourced light emitting diode beam 21 to transit through to the underlying pixel 32 in the photodetector. The first metal film 25 is a reflector for the low level radiation. Next a sacrificial film is deposited and patterned in gap space 26 over the first metal 25 and support structure 24 to form an underlying surface for the deposition of platform structural support 30 anchors and tetherbeams. The sacrificial film in gap 26 is a high temperature polyimide or another polymer that is patterned to provide vias for the anchors for the platform structural support. Next the structure 30 of LPCVD silicon dioxide are deposited at a maximum temperature of 350 deg C and patterned to define the platform, tetherbeams, and anchors. Structure 30 can alternatively be deposited and patterned in the form of a bimorph or multimorph with two or more layers of differing thermal coefficient of expansion. Multiple depositions of tetherbeam 30 films are deposited and patterned to achieve the desired elevation and thermal conductivity as described in US patent

gallium arsenide or gallium nitride or alloys thereof including GaAsP, GaAlN, and InGaN.

15: The pixel of claim 1 where said sacrificial layer is polyimide and said tether beams include silicon dioxide.

16: The pixel of claim 1 where said sacrificial layer is silicon and said tetherbeams contain silicon dioxide.

17: The pixel of claim 1 arranged into an array with support posts of individual platforms shared by adjacent pixels thereby reducing the overall substrate area required and increasing the fill factor.

18: The structure of claim 1 with said photodetector integrated into said planer substrate.

19: The structure of claim 1 operated within a conventional vacuum chamber enclosure.

Cancelled Claim 20: An enclosing microstructure for the purpose of maintaining a partial vacuum surrounding the pyro-optical film.